ZKM Research Project 2001-3

ID_Cine

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1.0 Introduction

The goal of this research project is to develop new and innovative techniques concerning **I**nteractive **D**igital **Cine**matography which encompasses both the hardware and software of its production, post-production, visualisation and content creation technologies.

This project takes as its point of departure the rapidly evolving digital methodologies in all the cinematic fields including film making, video games, DVD, the location based entertainment industries, Internet and networked distributed multi-user systems, and most significantly the domestic convergence of home cinema, interactive television and all forms of personal computing.

The project recognises that this powerful digital convergence of heterogeneous multimedia technoligies provides the opportunity to develop *completely new paradigms of interactive functionality and experience in the cinematic domain* – paradigms which can have enormous implications in the field of culture, entertainment and industry.

2. 0 Theoretical context

2.1. Cinematic applications – interactive and immersive cinema

The cinema industry is currently undergoing far-reaching transformations as a result of the application of digital technologies in both film production and post-production processes. While impacting the traditional cinematic formats, these technologies also enable the cinema to move from linear to non-linear interactive formats. Such interactive modalities will for instance enable the viewers to access, edit and view multi-temporal video streams, allowing for greater experiential and imaginative immersion by the viewer in their interaction with these multiple narrative fields. Films like *Time Code and Run Lola Run* already have already given us linear intimations of these non-linear interactive possibilities. There are significant challenges for implementing these interactive formats, especially in relation to a mass audience in a movie-theater like environment. Single user interaction will transform the cinema into a performance situation where every showing is a unique interpretation. Multi-user interaction opens the possibility for multiple synchronous viewpoints inside the narrative space. There are also important implications for the architecture of the cinematic presentation space Linear film constituted movie theaters with a seated audience in front of a single screen with a fixed projection source. Interactive cinema can draw on the recent history of experimental configurations in theater as well as current innovations in immersive virtual environments to propose radically new relationships between the audience and projected image(s).

2.2. Location based entertainment industry applications – synthetic environments using heterogeneous technologies

The film industry has already begun to explore new cinematic formats in the context of popular location based entertainment centers. IMAX, OMNIMAX, ride films and the interactive experiences offered by Disney Quest are some salient examples. Trade fairs and EXPO type exhibitions have also become a context for experimental applications that are also taking the cinema into new formal and experiential realms. And in the

cultural sector, major international institutions such as the ZKM Karlsruhe, the Ars Electronica Center in Linz, the National Center for Film, Television and Photography in Bradford and the Australian Center for the Moving Image in Melbourne are demonstrating the capacity of the digital cinematic technologies to give unusual new forms to both didactic and artistic installations. The continuously growing public attendance figures at such location based entertainment centers points signals an accelerated development of variegated and technologically sophisticated multimedia applications in this field, and especially those that offer new forms of immersive interactive experiences. Many of the techniques that have been developed on behalf of the film industry but which were till now only accessable to the public in a filmic form can now be reconstrued as hands-on experiences. This also implies that the narrative traditions of the cinema can be reformed to now engage with the active viewers own creative participation, which opens a broad new domain of kinesthetic and synaesthetic extensions of the cinema's expressive possibilities.

2.3 Internet and distributed 'home cinema' applications

While the growing attractions of location based entertaintainment centers, and the nomadic dislocated qualities of the internet seem to point to an entertainment and communications locus outside the home, it is in the domestic sphere that the most radical developments are likely to take place in the near future. High bandwidth internet connectivity in the home will open that environment to the complete gamut of multimedia content forms ranging from the cinema to interactive television to video games, as well as enabling access to highly articulated audio-visual global intercommunication systems. To accomodate these evolving technologies, the current space of the 'home cinema' will evolve into sophisticated multimedia communications environments that are seamlessly linked to a global network – a ubiquitous distributed cyberspace of diversive, cultural and social exchanges. Yet at the same time such domestic nodes in this network will remains havens of individuality and the intimate sociality that belongs to private and family life. This successful conjunction of global interconnectivity with personal privacy is what will make the future 'home cinema' a preferred modality of engagement with the experiences offered by these new technologies. This prospect offers enormous design challenges for these technologies, for instance the developed of interface strategies which maximize the seamless integration of heterogeneous multimedia data forms with a multi-sensorial responsiveness to the specific needs of each user.

3.0 Project methodolgy:

Our project intends to develop robust prototypical hardware and software solutions based on highly original concepts. The project shall draw on the electronic engineering and computer programming skills of ZKM Institute für Bildmedien employees as well as experts (scientific and artistic) who will be specifically engaged for this purpose.

Because of the technologically challenging nature of this project, we shall seek to make best use of industrially available and proven products wherever these are applicable, so that our research effort can focussed in those areas that are truly innovative and have the most potential for future applications.

The technological solutions that this project shall generate will be implemented in a content rich environment, with a strong emphasis on cultural and artistic applications which by their nature put very great demands on these tehnologies. In this way practical demonstrators will be generated that when presented to a general public can be scientifically, socially and aesthetically evaluated .

4.0 Research focus:

To achieve the maximum effectiveness of this projecrt, our research effort shall be directed in the following interelated areas: production, post-production, visualisation, user interfaces, content creation, and public evaluation.

4.1 The development of new hardware and software technologies for the real time recording of immersive cinematic images and sound:

4.1.1 a 360 degree high resolution panoramic video camera - PANSURROUND - constituted by a custom engineered construction of 15 CCD cameras and 15 DVD recorders. This is an ultra-high resolution system capable of recording 720 x 8000 pixels per frame – i.e. eight times better than the current ‚high definition' standard.

4.1.2 a 360 x 220 degree fisheye film recording sytem – PANOSPHERE - using the 35mm VistaVision high resolution film format

4.1.3 a 32 channel spatially articulated audio recording system – PANOCOUSTIC - that can be applied with both the panoramic video and fisheye film recording systems

4.2 The development of new hardweare and software technologies for the digitization, image processing and post production of audio visual materials generated by the PANOSURROUND, PANOSPHERE and PANOCOUSTIC systems:

- a hardware and software environment that enables the video sequences that were recorded with the ultra-high resolution PANOSURROUND system to be optically corrected and stitched together into seamless panoramic movies with a final resolution of 700 x 5000 pixels
- a custom integrated fully automated system for digitizing the 35mm VistaVision films generated by the PANOSPHERE camera at a resolution of 4000 x 4000 pixels per frame

4.2.3 a custom developed post-production environment for processing and integrating the 32 channel audio recordings made with the PANOCOUSTIC system

4.3 New hardware and software technologies concerning the computing platforms, visualisation systems and user interfaces that allow the above described recording and post-production techniques to be exploited for content rich interactive applications in the sphere of culture, entertainment and industry:

4.3.1 The four projection surfaces of the CAVE system, first developed some years ago at the University of Illinois, was the first fully immersive interactive stereographic environment. Its biggest disadvantage is it's technological complexity, very high cost and very high maintenance overheads. In the **ID-Cine** project we shall create an equivalent system with just two projection surfaces, and instead of a high cost Silicon Graphics super computer we will develope a multiple synchronized PC solution equipped with low cost NVIDIA graphics boards. To achieve the immersive CAVE experience in this way, custom hardware and software components will be developed that have significant commercial potential.

4.3.2 The motion platforms that were first developed for military and flight simulation applications are now finding their way into localtion based entertainment centers. This technology has the unique capability of offering both audio-visual and direct physical (kinesthetic) experiences to the viewer. While the US and European film making industries have already started to make special ‚ride films' for such motion platforms, artistic and culturally qualititative applications in this field almost non-

existant. The **ID-Cine** project will develop new applications in this field that demonstrate the unique possibilities of such systems to embody new forms of content.

4.3.3 In OMNIMAX theaters and certain location based entertainment centers like Disneyworld, film based projection systems for full dome and 360 degree panoramic applications are already existant. These are linear non-interactive experiences. In the **ID-Cine** project we shall explore the possibilities of such spherical, semi-spherical and panoramic projection environments as a unique context for interactive non-linear multimedia applications. The nature of such immersive environments offers completely new opportunities for interactive content design that are quite distinct from frontal flat screen applications, and which will have great potential in the cultural, industrial and enteretainment industries. Innovative approaches to multi-screen and multi-projector environments are also considered to be of relevance in this context.

4.3.4 The **ID-Cine** rsearch focus on new forms of projection environment also necessitates new thinking in relation to the projection technologies themselves. The current paradigm for both film and video based projection techniques in based on a static fixed position projector(s). The **ID-Cine** project will develope a new paradigm based on the notion of mobile projection systems that will be able to inrteractively move the projected image over the surface of its large spherical and/or panoramic projection screens. In this way (and also cost-effectively) very large surface visual databases and films can be created that can be explored via the viewer's control over the movement of the projection window. Of course such systems necessitate the creation of very high resolution visual datasets, as will be provided by the PANOSURROUND and PANOSPHERE recording and post-production technologies being developed within the **ID-Cine** project.

4.3.5 As already indicated, the **ID-Cine** project is predicated wherever possible on the use of cost effective Linux based PC computing solutions, rather than high end Unix workstations. To achieve this there are significant software development challenges, particularly in the field of compression and high speed real time access to the Terabytes of high resolution cinematic data that have been created for example by the PANOSURROUND and PANOSPHERE systems. Furthermore the **ID-Cine** project will further develope the proprietry ZKM software application environments *Xfrog* and *MTK* which enable complex algorithmically generated computer animations to be implemented in a real time interactive context.

4.3.6 The **ID-Cine** project is focussed on interactive digital cinematic techniques and applications. Therfor the issue of innovative and effective user interfaces is of paramount importance, and this will be an **ID-Cine** primary research area. We will develop new technologies that allow viewer's head and hand gestures to be sensed and measured, as well as technologies that will track the position of viewers' movements in space. Furthermore we will develope interfaces for mobile projection surfaces that enable large databases to be spatially distributed and explored, while another research focus will be the user interface to spatially distributed audoo data such as will be generated by the PANOCOUSTIC system. The

ID-Cine project will also be able capitalise and advance on the many successful interface concepts and designs developed by the ZKM Institute für Bildmedien during its 1997-2000 European Commission ESPRIT research projects eRENA and eSCAPE.

4.3.7 The **ID-Cine** project is also very much focussed on developing cinematic applications that are Internet based and which offer distributed multi-user networked capability. The aim its to achieve a maximum scaleability of it software applications that will range from the very high bandwidth of its projection installations to the medium and low bandwidth of DVD and networked environments. While current experiments in streaming video are already entering the cinematic domain, their technologies cannot scale up to the full size theatrical presentations such as we are used to in the cinema. The **ID-Cine** approach is to first establish technologies that are capable of high resolution large scale cinematic experiences, and then scale these down in the other contexts using appropriate design strategies. Another distinctive feature of networked multi-user systems is their distributed multi-locational character, allowing interactivity by many participants from anywhere in the world. This offers a special challenge for the design of content rich narrative applications, that will be addresssed in the **ID-Cine** project.

4.3.8 *,In the cinema, or at least in the narrative cinema – and all cinema is narrative to a certain degree – it is the type of image produced that determines the narrative, not the reverse.'* (Raul Ruiz). The **ID-Cine** project, with all its innovative technologies, maintains a basic relationship to the traditions of cinematic and literary narrative, and sets out to discover new forms of narrative design and narrative structure that are appropriate to the interactive techniques, environments and user interfaces that it will develope. We see this as one of the core challenges of this project, whose achievements in this area will be of great significance to the future of the cinema as a whole, including the video game and location based entertainment industries.

5.0 Content Creation

The success of the ID-Cine project is predicated on full integration of its scientific research effort with content rich applications of that research. Both the scientists and artists involved in this project will undertake innovative content development that will result in demstrators that can be fully evaluated in a public context. The artistic aspect will play a fundamental role in this process, with internationally renowned figures being invited to participate in this project including Prof. Masaki Fujihata (artist, Japan), Prof. Norman Klein (writer, USA), Jean-Michel Bruyere (theater director and film maker, France), Rich Gold (artist and scientist, USA), Michael Gleich (writer, Germany), Dr. Dennis del Favoro (artist, Australia), Marcus Huemer (artist, Germany), Lev Manovitch (writer, USA). Answering the major challenges offered by the development of new paradigms of interactive narrative will be a special focus of this artistic effort.

6. 0 Partners

ID_Cine is an ambitious cutting edge research project that offers extremely attractive opportunities for international cooperation. At this stage the ZKM Institute für Bildmedien has already secured firm committments from the following institutions who

are prepared to act as partners in this project both on the level of financial and in-kind contributions. Estimated total value of these partner's contribution is over Euro 500.000:

- *The University of New South Wales Center for Interactive Cinema Research*, (Sydney) in relation to **ID_Cine**'s Internet and networked multi-user applications.
- *The University of Southern California School of Film and Television Annenburg Center* (Los Angeles), in relation to **ID_Cine**'s interactive DVD applications.
- *Xerox Parc* (PaloAlto), in relation to the development of the TILTY TABLE technogy and applications
- *Le Fresnoy National Studio of Contemporary Arts* (Tourcoing), to enable productions with **ID_Cine**'s innovative film and video technologies using Le Fresnoy's very extensive professional film and video facilities.
- *Lille Cultural Captital 2004*, whose cultural program will give **ID_Cine** a prestigious platform for the public presentation of of its demonstrators by offering special commisions to selected renowned international filmmakers such as Lars von Trier, Raul Ruiz and Peter Grenaway to makes interactive films using our **ID_Cine** technologies
- *Daniel Langlois Foundation* (Montreal), who will be giving financial support to the ZKM for the exhibition of **ID_Cine** completed works.